

REMARKS

By this Amendment, Claims 14, 16, 17, 19, 20, 34 and 35 are amended, and Claims 33 and 36 are cancelled, leaving Claims 14-17, 19-32, 34, 35 and 39 pending in the application. Applicants respectfully submit that the claim amendments do not (a) raise any new issue that would require further consideration and/or searching, (b) raise the issue of new matter, or (c) add any additional claims, and (d) the amendments place the application in better condition for appeal. Accordingly, entry of the amendments is respectfully requested. Reconsideration of the February 20, 2004, Office Action is respectfully requested in view of the following remarks.

Personal Interview

Applicants thank Examiner Uhlir for the courtesies extended to their undersigned representative during the personal interview conducted on May 13, 2004. Applicants' separate record of the substance of the interview is incorporated in the following remarks.

Allowable Subject Matter

Applicants gratefully acknowledge the indication in the Office Action that Claims 23 and 24 have been allowed. For the reasons stated below, however, it is respectfully submitted that all other pending claims also are patentable.

Rejections Under 35 U.S.C. §103

A. Claims 14-17, 19-21, 25-29, 31-33 and 35-36 stand rejected under 35 U.S.C. §103(a) over U.S. Patent No. 5,916,454 to Richardson et al. ("Richardson") in view of EP 0845545 to Ding et al. ("Ding"). Claims 33 and 36 have been cancelled. The reasons for the rejection are stated on pages 2-9 of the Office Action. The rejection is respectfully traversed.

Independent Claim 14, as amended, recites a component of a plasma etch reactor, "which is selected from the group consisting of a plasma confinement ring, a focus ring, a pedestal, a chamber wall, a chamber liner and a gas distribution plate, the component having one or more surfaces exposed to the plasma during processing, the component comprising an as-sprayed plasma sprayed coating on a plasma exposed surface of the component, the coating being a ceramic material selected from the group consisting of alumina, yttria, zirconia, silicon carbide, silicon nitride, boron carbide and boron nitride, and the coating having an as-sprayed surface roughness that promotes the adhesion of polymer deposits formed during etching of semiconductor substrates in the plasma etch reactor" (emphasis added).

Support for the amendment to Claim 14 is provided in Claim 20.

The Office Action acknowledges that Richardson fails to disclose or suggest a coating for a plasma chamber part, much less a plasma sprayed coating as recited in Claim 14. However, it is asserted in the Office Action that Richardson discloses that roughening the surface of a plasma chamber part increases the adhesion of particles to the surface, and that Ding teaches that by further coating the surface of a roughened chamber part with a plasma sprayed coating, the adhesion of particles to

the chamber part can be further improved. Applicants respectfully disagree with these assertions for the following reasons.

Ding is directed to increasing the adherence of target material sputtered from a sputter target on parts in a sputter deposition chamber. Ding discloses that due, for example, to a mismatch between the grain structure of the deposited layer 29 and the particle screening device 15, the deposited layer 29 of target material is not strongly adhered to the particle screening device 15, causing it to peel off the device contaminate substrates in the sputtering chamber 11 (column 5, lines 23-29).

Ding discloses applying a coating 33 of a material having a composition that is specifically selected depending on the composition of the deposited layer 29 deposited on the coating 33. However, the deposited layer 29 is of the material sputtered from the target 17, and not of material formed during etching of a semiconductor substrate. Ding discloses that coating 33 applied on the particle screening device 15 has a coefficient of thermal expansion (CTE) that is similar to that of the deposited layer 29 to eliminate thermal stress that occurs when materials having different CTE values undergo successive heating and cooling required of semiconductor device fabrication equipment (column 3, lines 38-43). In fact, Ding discloses that the coating 33 preferably is formed of the same sputter target material (column 5, lines 49-56).

In contrast to Ding, the component of a plasma etch reactor recited in Claim 14 comprises a plasma-sprayed coating that promotes the adhesion of polymers formed during etching of semiconductor substrates in the reactor. The coating is of “a ceramic material selected from the group consisting of alumina, yttria, zirconia, silicon carbide, silicon nitride, boron carbide and boron nitride.” Ding discloses that

the coating 33 needs to be similar to, and preferably the same as, the sputter target 17 material to eliminate thermal stress. Ding does not suggest that the sputter target 17 could be a polymer material, and thus does not suggest any material for the coating 33 that could be applied as a plasma-sprayed coating to promote the adhesion of such polymer material.

Richardson addresses the problem of byproduct adhesion to the surface of plasma chamber interior parts by providing a roughened, uncoated surface. Richardson does not suggest that there is any problem regarding byproduct adhesion to the roughened surface, but rather discloses that byproduct adhesion is promoted by the roughened surface. Although Ding discloses that the surface of the particle screening device 15 that is coated can be roughened to increase adhesion between the particle screening device 15 and the coating 33 (column 6, lines 32-45), Ding provides no motivation to apply such coating on Richardson's roughened, uncoated surface, because Richardson discloses that the uncoated surface already successfully achieves its intended purpose of promoting the adhesion of byproducts. Merely because reference teachings may be combined does not render the resulting combination obvious; rather, the references must also provide some suggestion of the desirability of the combination. See, for example, In re Fritch, 13 USPQ2d 1780, 1783-84 (Fed. Cir. 1992). Accordingly, even if Richardson's uncoated surface could be coated according to Ding's teachings, Richardson and Ding fail to suggest any reason why such modification might be desirable.

Also, Ding provides no suggestion that coating Richardson's wall would result in a modified structure that would be as effective as Richardson's uncoated chamber part surfaces for promoting byproduct adhesion. As explained above, Ding at the

least does not suggest any material for the coating 33 that could be applied as a plasma-sprayed coating to promote the adhesion of polymer deposits, much less the ceramic materials recited in Claim 14. It is submitted that absent any such teaching by the cited references, the effectiveness of the resultant modification of Richardson's uncoated surface for promoting the adhesion of polymer deposits formed during etching of semiconductor substrates is entirely speculative. However, a rejection under 35 U.S.C. § 103 must be supported by a factual basis, rather than on such mere speculation. In re Warner, 154 USPQ 173, 178 (CCPA 1967). It is well-established that there must be a reasonable expectation of success resulting from an asserted modification. See MPEP § 2143.02. It is respectfully submitted that the Office Action has failed to provide evidence that meets this requirement.

Moreover, the modification of Richardson's chamber parts advanced in the Office Action would require adding the manufacturing costs and other factors associated with applying Ding's coating to the parts. It is respectfully submitted that one having ordinary skill in the art would not have been motivated to modify Richardson's uncoated chamber parts to include Ding's coating without a reasonable expectation of success and without some advantage to be gained from the modification, especially knowing that added manufacturing costs would be required for the modification.

Thus, it is respectfully submitted that the Office Action has failed to establish a *prima facie* case of obviousness regarding the component recited in Claim 14. Dependent Claims 15, 19 and 25-32 also are patentable over the combination of Richardson and Ding for at least the same reasons that Claim 14 is patentable.

Claim 16, as amended, recites a component of a plasma etch reactor, "the component comprising aluminum having an anodized or non-anodized plasma exposed surface, the component comprising an as-sprayed plasma sprayed coating on a plasma exposed surface of the component, the coating being a ceramic material selected from the group consisting of alumina, yttria, zirconia, silicon carbide, silicon nitride, boron carbide and boron nitride, and the coating having an as-sprayed surface roughness that promotes the adhesion of polymer deposits formed during etching of semiconductor substrates in the plasma etch reactor" (emphasis added). For reasons stated above, it is respectfully submitted that the component recited in Claim 16 also is patentable over the combination of Richardson and Ding. Dependent Claims 20 and 22 also are patentable for at least the same reasons that Claim 16 is patentable.

Independent Claim 17 recites a component of a plasma etch reactor, "the component being made from a ceramic material selected from the group consisting of alumina, yttria, zirconia, silicon carbide, silicon nitride, boron carbide and boron nitride, . . . the component comprising an as-sprayed plasma sprayed coating on a plasma exposed surface of the component, the coating being a ceramic material selected from the group consisting of alumina, yttria, zirconia, silicon carbide, silicon nitride, boron carbide and boron nitride, and the coating having an as-sprayed surface roughness that promotes the adhesion of polymer deposits formed during etching of semiconductor substrates in the plasma etch reactor" (emphasis added). For reasons stated above, it is respectfully submitted that the component recited in Claim 17 also is patentable over Richardson and Ding. Dependent Claim 35 also is patentable for at least the same reasons that Claim 17 is patentable.

Independent Claim 21 recites a component of a plasma etch reactor "comprising an as-sprayed plasma sprayed coating on a plasma exposed surface of the component, the component and the coating both comprising the same ceramic material selected from the group consisting of alumina, yttria, zirconia, silicon carbide, silicon nitride, boron carbide and boron nitride, and the coating having an as-sprayed surface roughness that promotes the adhesion of polymer deposits formed during etching of semiconductor substrates in the plasma etch reactor" (emphasis added). It is respectfully submitted that the component recited in Claim 21 also is patentable over Richardson and Ding.

Therefore, withdrawal of the rejection is respectfully requested.

B. Claims 14-17, 19-21, 25-36 and 39 stand rejected under 35 U.S.C. § 103(a) over WO 99/20812 to Yin et al ("Yin") in view of Richardson and Ding. Claim 36 has been cancelled. The reasons for the rejection are stated on pages 9-17 of the Office Action. The rejection is respectfully traversed.

The Office Action asserts that Yin discloses a plasma etch reactor comprising an enclosed etching chamber and that portions of the enclosed chamber are coated with a ceramic, such as aluminum oxide, boron carbide, boron nitride, silicon, silicon oxide, silicon carbide or silicon nitride to protect the walls from eroding during chamber cleaning. It is acknowledged in the Office Action that Yin fails to disclose a plasma-sprayed coating having an as-sprayed surface roughness that promotes the adhesion of polymer deposits, as recited in Claim 14. However, it is asserted in the Office Action that it would have been obvious to coat the plasma etch reactor interior components disclosed by Yin with aluminum, as taught by Ding. Applicants respectfully disagree with these assertions for the following reasons.

Yin discloses a method for cleaning an etching chamber. Yin discloses that during etching processes, polymeric byproducts can form, which byproducts deposit as residue layers on the walls and components in the chamber (page 1, line 25, to page 2, line 4). Yin discloses that the etch residue layer has to be periodically cleaned to prevent contamination of substrates, as well as to provide internal chamber surfaces that have consistent and homogeneous chemical compositions and surface functionality (page 2, lines 8-11).

Yin discloses an etching chamber 30 comprising one or more ceramic surfaces. The ceramic material can be a coating (page 12, lines 18-26). Yin fails to disclose how the coatings are applied, much less that the coatings are plasma sprayed coatings.

It is respectfully submitted that Richardson and Ding provide no motivation to modify Yin's etching chamber to achieve the combination of features recited in Claim 14. First, Claim 14 recites that the plasma sprayed coating is a ceramic material, while the Office Action acknowledges that Ding discloses an aluminum coating, i.e., a metal coating. Richardson and Ding fail to provide motivation to modify Yin's etch chamber to result in the combination of features recited in Claim 14, including at least the features the "the component comprising an as-sprayed plasma sprayed coating on a plasma exposed surface of the component, the coating being a ceramic material selected from the group consisting of alumina, yttria, zirconia, silicon carbide, silicon nitride, boron carbide and boron nitride, and the coating having an as-sprayed surface roughness that promotes the adhesion of polymer deposits formed during etching of semiconductor substrates in the plasma etch reactor" (emphasis added).

Moreover, Yin's chamber cleaning process is directed to removing etchant deposits on the chamber surfaces. Clearly, Yin does not suggest modifying the etching chamber to increase the adhesion of polymer deposits on the chamber surfaces, as this result would require the cleaning process to then have to remove more etching deposits from the chamber surfaces to achieve the desired surface state. Also, Yin does not suggest that the cleaning process would be effective in removing an increased amount of polymer deposits, much less from such a modified roughened surface.

Thus, it is respectfully submitted that Richardson and Ding fail to provide motivation to modify Yin's etch chamber to result in the combination of features recited in Claim 14. Therefore, it is respectfully submitted that Claim 14 and dependent Claims 15, 19 and 25-32 also are patentable over the combination of Yin, Richardson and Ding.

For reasons stated above, Richardson and Ding also fail to provide motivation to modify Yin's etch chamber to result in the combination of features recited in independent Claim 16, including at least the features that "the component comprising an as-sprayed plasma sprayed coating on a plasma exposed surface of the component, the coating being a ceramic material selected from the group consisting of alumina, yttria, zirconia, silicon carbide, silicon nitride, boron carbide and boron nitride, and the coating having an as-sprayed surface roughness that promotes the adhesion of polymer deposits formed during etching of semiconductor substrates in the plasma etch reactor" (emphasis added). Accordingly, the subject matter recited in Claim 16 and dependent Claims 20 and 22 also is patentable over the combination of Yin, Richardson and Ding.

For reasons stated above, Richardson and Ding also fail to provide motivation to modify Yin's etch chamber to result in the combination of features recited in independent Claim 17, including at least the features that "the component comprising an as-sprayed plasma sprayed coating on a plasma exposed surface of the component, the coating being a ceramic material selected from the group consisting of alumina, yttria, zirconia, silicon carbide, silicon nitride, boron carbide and boron nitride, and the coating having an as-sprayed surface roughness that promotes the adhesion of polymer deposits formed during etching of semiconductor substrates in the plasma etch reactor" (emphasis added). Accordingly, the subject matter recited in Claim 17 and dependent Claim 35 also is patentable over the combination of Yin, Richardson and Ding.

For reasons stated above, Richardson and Ding also fail to provide motivation to modify Yin's etch chamber to result in the combination of features recited in independent Claim 21, including at least the features that "the component and the coating both comprising the same ceramic material selected from the group consisting of alumina, yttria, zirconia, silicon carbide, silicon nitride, boron carbide and boron nitride, and the coating having an as-sprayed surface roughness that promotes the adhesion of polymer deposits formed during etching of semiconductor substrates in the plasma etch reactor" (emphasis added). Accordingly, the component recited in Claim 21 also is patentable over the applied references.

Independent Claim 34 recites a component of a plasma etch reactor, which comprises "a coating formed by a process consisting essentially of plasma spraying a coating material on a plasma exposed surface of the component that has not been roughened, the coating being a ceramic material comprising at least one material

selected from the group consisting of yttria, alumina, zirconia, silicon carbide and boron carbide, the coating having an as-sprayed surface roughness that promotes the adhesion of polymer deposits formed during etching of semiconductor substrates in the plasma etch reactor” (emphasis added). For reasons stated above, the subject matter recited in Claim 34 and dependent Claim 35 also is patentable over the combination of Yin, Richardson and Ding.

Therefore, withdrawal of the rejection is respectfully requested.

Conclusion

For the foregoing reasons, withdrawal of the rejections and prompt allowance of the application are respectfully requested. Should the Examiner wish to discuss this application, the undersigned attorney can be reached at the telephone number given below.

Respectfully submitted,

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